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ABSTRACT

This paper discusses selected techniques for measuring equity in a state school finance system and focuses on the distribution of fiscal outcomes among school districts in Pennsylvania. Measures of dispersion, measures of relationship, and winners-losers ratios are demonstrated with data from a small sample of school districts. Data from a statewide study of Pennsylvania for the 1983-1984 school year show a full-scale application. Two equity themes are analyzed. Equalization of fiscal outcomes calls for equal expenditures among all students; fiscal neutrality holds that the quality of education may not be a function of wealth and that fiscal outcomes may vary according to local willingness to pay. The goal of "ex ante" fiscal neutrality is equalization in districts' earning ability. "Ex post" fiscal neutrality concerns making the funding of poorer districts equal to that of wealthier districts. Measures of equity among the 10 school districts are presented in 5 tables of data. Variables are revenue per pupil, instructional expense per pupil, tax rate, and wealth per pupil. Results indicate that neither "ex ante" fiscal neutrality nor "ex post" fiscal neutrality demonstrates a relationship to tax effort or to tax base wealth. In assessing the equity of Pennsylvania's finance system, variables considered included size, population density, percent of white population, and percent of poverty level students. Differences in expenditures per pupil are associated slightly with differences in achievement. (CJH)

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EQUITY AND DIVERSITY: A CHALLENGE FOR THE ALLOCATION OF FINANCIAL RESOURCES

by

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EQUITY AND DIVERSITY IN SCHOOL FINANCE

Considerable differences in the amount of financial resources for education often exist from district to district within the same state. Are these differences justifiable? Proponents of equity have cried, "No!" Others have argued that the diversity is legitimate and reflects the varying will of the districts to provide education.

The degree to which financial equity exists among districts is not as easily measured as it might appear. There are two different, and possibly conflicting, standards of equity. One equity theme is equalization of fiscal outcomes (revenues, expenditures and tax rates). A pure version of this standard would not permit any student to obtain a more expensive education than that afforded any others. The second equity standard, fiscal neutrality, holds that the quality of public education may not be a function of wealth, other than the wealth of the state as a whole. According to this standard, fiscal outcomes may vary among districts according to local willingness to pay for public schooling.

The definition of fiscal neutrality includes two different, and possibly conflicting, concepts also. The ex ante variety of fiscal neutrality maintains that districts levying equal tax rates should have equal revenues and expenditures regardless of their tax base wealth differences. The goal here is an equitable school finance process that equalizes the ability of districts to earn educational funds. The concern of ex post fiscal neutrality is not with the process but with the end products of a school finance system. Ex post fiscal neutrality holds that wealthy districts should not have more educational funding than poor districts. This second kind of fiscal

neutrality requires that there be no systematic relationship between district tax base wealth and each district's fiscal outcomes.

Three types of measures may be used to assess the equity of a state's school finance system. Dispersion measures indicate the degree of equalization in distributions of fiscal outcomes among districts. Relationship measures disclose the degree of fiscal neutrality attained by distributions of fiscal outcomes. Winners and losers ratios reveal those district characteristics associated with advantageous and disadvantageous distributional effects.

In addition to discussing the above concepts, the presentation examines an application of them to the school finance system in Pennsylvania.

The Sample

The measures of equity are illustrated with a data set for a sample of ten school districts in Pennsylvania. The sample was limited in size to facilitate demonstrating the measures clearly. The data are for the school year 1983-84 (see Table 1).

The variables were defined operationally as follows:

Revenue per pupil. The sum of local, state, and federal revenues recorded in the general fund divided by student enrollment.

Instructional expense per pupil. The sum of general fund expenditures less expenditures for health services, transportation, debt service, capital outlay, homebound instruction and outgoing transfers to community colleges and technical institutes divided by student enrollment.

Tax rate (equalized mills). A school district's total local taxes divided by the estimated market value of real estate in the district.

Wealth per pupil. Estimated market value of real estate in a school district divided by student enrollment (reported in millions of dollars per pupil).

Table 1

Illustrative Data Set

District	Enrollment	Revenue / Pupil	Inst. Exp. / Pupil	Tax Rate (EM)*	Wealth / Pupil
A	8,130	$3813	$2428	37.3	$ 33.6
B	7,790	3851	2746	25.6	110.2
C	4,900	3877	2667	32.8	73.1
D	4,890	3681	2607	26.1	98.4
E	4,710	4671	2933	23.1	149.9
F	3,940	4061	2642	31.7	70.6
G	3,760	3457	2483	28.4	75.5
H	3,240	4321	3056	20.6	166.3
I	3,160	3797	2568	27.1	95.2
J	2,750	5454	3968	21.7	213.9

* EM Equalized mills; 1 mill = $ .001

Measures of Dispersion

A dispersion measure reflects the degree to which values in a distribution deviate from a central value. In the equity sense, if all values were equal, there would be no dispersion; hence, perfect equity would exist. As the measure of dispersion increases, the distribution moves away from equity.

Coefficient of variation. This measure is defined operationally as the standard deviation of a distribution divided by its mean (Carroll et al., 1979). It represents the standard deviation as a percent of the mean.

$$\frac{\text{Standard Deviation}}{\text{Mean}} = \text{Coefficient of Variation}$$

Results of the computation for the coefficient of variation are displayed in Table 2. Additional results from a statewide study of Pennsylvania (N=501 districts) are included. The statewide results reveal a general trend away from equity from 1975-76 to 1980-81 despite the enactment of legislation in 1977 and in 1979 to revise the subsidy process in Pennsylvania.

For the illustrative sample, the coefficient of variation for revenue per pupil indicates that, in a normal distribution, two-thirds of the districts would fall within plus or minus 14 percent of the mean ($4,098.30). For instructional expense per pupil, two-thirds of the districts would occur within plus or minus 15 percent of the mean ($2,809.80); and for tax rate, within plus or minus 18 percent of the mean (27.44 mills). For each variable in the order presented, the dispersion was progressively greater. Comparison with the statewide results for Pennsylvania is confounded by changes in the accounting system as well as the small size of the sample.

Relative deviation from the median. This measure is defined operationally as the mean absolute deviation from the median divided by the median (Carroll et al., 1979). It may also be computed by dividing half the difference between the mean fiscal outcome value for districts above the median and the mean value for those below the median by the median.

A. $$\frac{\frac{\Sigma|\text{Median} - X|}{N}}{\text{Median}} \quad \text{or} \quad \frac{\Sigma|\text{Median} - X|}{N \text{ Median}} = \text{Relative Deviation}$$

B. $$\frac{.5\ (\bar{X}_1 - \bar{X}_2)}{\text{Median}} = \text{Relative Deviation}$$

Where $\bar{X}_1$ = Mean of values above the median
$\bar{X}_2$ = Mean of values below the median

Table 2

Coefficient of Variation for Selected
Fiscal Outcome Variables

	Revenue / Pupil	Inst. Exp. / Pupil	Tax Rate
Illustrative Sample (N=10)			
Standard Deviation	555.39	426.85	4.99
Mean	4098.30	2809.80	27.44
Coefficient of Variation	.14	.15	.18
Pennsylvania (N=501)*			
Coefficient of Variation			
1975-76	.15	.16	.18
1976-77	.16	.16	.19
1977-78	.17	.17	.20
1978-79	.18	.17	.20
1979-80	.18	.18	.20
1980-81	.19	.18	.20

* Johnston, 1984.

Results of the computation for the relative deviation from the median are presented in Table 3. Additional results from the statewide study are included. The statewide results on this measure also reveal a trend away from equity. For the illustrative sample, the relative deviation was greatest for the tax rate variable (.15), which was also true for the statewide study in the earlier period.

The relative deviation represents the percent by which an output variable would have to be increased to raise the below-median values to the mean of the above-median values. A relative deviation of .15 means that the upper group averaged 30 percent greater tax rates than those in the lower group. Additionally, the relative deviation times the median times the number of cases equals the amount required to raise the mean of the lower group to that

of the upper group. Before rounding the relative deviations, the following sums would be needed to level-up the below-median groups to the mean of the above-median groups:

Revenue per pupil	$3,785
Instructional expense per pupil	$2,642
Tax rate	40.2 mills

Table 3

Relative Deviation from the Median
for Selected Fiscal Outcome Variables

	Revenue / Pupil	Inst. Exp. / Pupil	Tax Rate
Illustrative Sample (N=10)			
$\Sigma\lvert$Median - X$\rvert$	3785	2642	40.2
Mean Absolute Deviation	378.5	264.2	4.02
Median	3864.00	2654.50	26.6
Mean of Values			
Above the Median	4476.80	3074.00	31.46
Below the Median	3719.80	2545.60	23.42
Relative Deviation	.10	.10	.15
Pennsylvania (N=501)*			
Relative Deviation			
1975-76	.11	.12	.15
1976-77	.12	.12	.16
1977-78	.13	.13	.16
1978-79	.13	.13	.15
1979-80	.13	.14	.16
1980-81	.14	.14	.16

* Johnston, 1984.

Measures of Relationship

Fiscal neutrality may be assessed by determining the degree of relationship between variables. What variables to consider, however, depends on whether interest is in the process or product of the financial system.

If the goal is to equalize the ability of districts to raise and expend funds, then districts levying equal tax rates should have equal funds regardless of differences in their tax bases. Districts may levy different rates to produce different sums but should not have to levy different rates to produce the same sum. Differences in funds, then, may reflect differences in tax rates but not in tax base wealth. This type of neutrality is known as ex ante fiscal neutrality. It may be measured by calculating the relationship (correlation) between revenue and expenditure variables and district effort (tax rate). A positive correlation indicates achievement of ex ante neutrality.

To pursue neutrality in fiscal outcomes, wealthy districts should not have more funds for education than do poor districts. There should be no relationship between the wealth (tax base) of districts and their revenue, expenditures, and tax rates; their correlations should be near zero. This type neutrality is known as ex post fiscal neutrality.

The correlations for both forms of neutrality are reported in Table 4. The Pearson r and r^2 (percent of common variance) were calculated for the data set reported in Table 1.

Table 4

Measures of Relationship between Selected School Fiscal Variables (N=10)

	Ex Ante Neutrality Tax Rate		Ex Post Neutrality Wealth/Pupil	
	r	r^2	r	r^2
Revenue per pupil	-.56	.31	.85	.72
Instructional expense Per pupil	-.66	.43	.91	.83
Tax rate (Equalized Mills)			-.90	.81

The results for ex ante neutrality (Table 4) showed moderately strong negative correlations between the revenue and expenditure variables and local effort (tax rate). In short, the greater a district's effort, the lower was its revenue and instructional expense per pupil. These results are in the opposite direction of the goal of ex ante neutrality.

The strong negative correlation between tax rate and wealth per pupil reflects the pronounced tendency for wealthy districts to have low tax rates while poor districts have high rates. Ex post neutrality is far from being realized in the sample. All correlations with wealth departed considerably from a value of zero. The results in Table 4 indicate that the sample demonstrates neither ex ante fiscal neutrality (a neutral process) nor ex post fiscal neutrality (neutral outcomes) in relation to tax effort or tax base wealth.

Winners and Losers

Another method for assessing the distributional effects of a state school finance system is to construct ratios to identify the winners and losers. For some district characteristic such as size or wealth, the districts are divided at the median. For example, on the variable of size districts would be divided into "large" (above the median) and "small" (below the median). The mean revenue per pupil may then be calculated for each group. The ratio of the mean for the lower group to the mean of the upper group is then calculated.

$$\frac{\text{Mean revenue per pupil (small districts)}}{\text{Mean revenue per pupil (large districts)}}$$

A ratio greater than 1.0 indicates that those districts below the median on the selected characteristic had a higher mean fiscal outcome than did those which were above the median. In the above example, a ratio greater than 1.0 would suggest that small districts were "winners" while large districts were "losers" on the variable revenue per pupil.

For the illustrative sample, the results of the winners-losers ratios are displayed in Table 5. On the characteristic of size (enrollment), the smaller districts were winners on revenue per pupil and instructional expense per pupil; the large districts were the winner on tax rate in the sense that they demonstrated greater effort. For wealth, the rich districts were the winners on the first two outcome variables. Poor districts put forth greater effort (higher tax rates) than did rich ones.

Table 5

Winners and Losers on Fiscal Outcomes
for Selected Characteristics (N=10)

	Revenue / Pupil	Inst. Exp. / Pupil	Tax Rate
Size (enrollment)			
Mean below median (small)	4218.0	2943.4	25.90
Mean above median (large)	3978.6	2676.2	28.98
Ratio	1.06	1.10	.89
Wealth (market value/pupil)			
Mean below median (poor)	3801.0	2557.6	31.46
Mean above median (rich)	4395.6	3062.0	23.42
Ratio	.86	.84	1.34

In the statewide study of Pennsylvania (Johnston, 1984), four characteristics were analyzed: size, density of population, percent of the population that was white, and percent of district students from families receiving Aid for Dependent Children. The winners in revenue and instructional expenditure distributions were those districts with lower percentages of white population, higher densities of population (more urban), larger enrollments, and greater percentages of poverty students.

Concluding Observations

This paper sought to illustrate selected techniques for measuring equity in a state school finance system. Measures of dispersion, measures of relationship, and winners-losers ratios were demonstrated with data from a small sample of school districts. The sample was kept small to permit replication of the computations easily. Data from a statewide study of Pennsylvania were included to show a full-scale application.

The focus in this paper was on the distribution of fiscal outcomes among the school districts in a single state. Similar approaches may be followed to compare states within a nation or to make comparisons at the local level. Locally, equity among a district's school sites or buildings could be measured. Equity between different levels of schooling or between different educational programs could be studied as well.

Whether or not equity, as operationally defined by the selected measures, is desirable was not addressed. In the end, what difference does it make? Is it a matter primarily of how public funds are distributed for education? Should each citizen have access to equal educational funding?

What are the consequences of diversity in educational funding on the mission of schools? Does diversity affect student achievement? A study in process in Pennsylvania (Harf, 1987) echoes previous findings that differences in expenditures per pupil are associated slightly with positive differences in achievement. Less than 6 percent of the differences in student elementary mathematics achievement was associated with differences in expenditures.

How public funds are distributed is a product of the political process. Mechanisms to protect the interests of minorty groups in this process are important to the maintenance of democratic goals. Measures such as those illustrated herein should prove helpful in monitoring the degree to which the rights of all citizens are protected in respect to the distribution of public funds for education.

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